

UNITED STATES PATENT APPLICATION

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FOR

METHOD AND SYSTEM FOR DIGITIZING FREEHAND GRAPHICS
WITH USER-SELECTED PROPERTIES

Cross-Reference to Related Applications

[001] This application claims priority benefits based on Swedish Patent Application No. 0000945-6, filed March 21, 2000, and U.S. Provisional Application 60/207882, filed May 30, 2000, the technical disclosures of both of which are hereby incorporated herein by reference.

Field of the Invention

[002] The invention relates generally to computer input methods and, more specifically, to methods for inputting freehand graphics.

Background of the Invention

[003] Methods for inputting graphical information into computers may be used to a great extent with various types of graphics programs, presentation programs, CAD programs, Web design programs, and the like. Such graphical information may be hand-drawn.

[004] Input systems for entering freehand graphics may include a base and a drawing device. When the drawing device is moved over the base, the movement of the drawing device may be recorded electronically as graphical input that may be transmitted to a computer system in digital form. In one such input system, the base may inductively detect the position of the drawing device relative to the base. By repeated recordation of this information, the movement of the drawing device across the base can be tracked and the corresponding image determined.

[005] Known input systems may often be expensive. They may also be unwieldy, particularly if the base has a large input surface and a palette to choose visual properties for the graphical inputs. Such limitations may prevent the use of such input systems in mobile applications.

Summary of a Few Aspects of the Invention

[006] Generally described, the invention may include a system for digitizing a freehand (i.e., hand drawn) graphic. The system may include a base having a surface (divided into a first area and a second area) and, on the surface, a position-coding pattern detectable by an optical sensor. The system may also include a drawing device having an optical sensor functional to detect a position in the position-coding pattern. Moreover, the system may include a microprocessor adapted (perhaps with computer software containing appropriate instructions) to perform the following actions: determining if the position detected by the optical sensor is in the first area or the second area; if the position is in the first area of the surface, then interpreting the position as a point in the freehand graphic; and if the position is in the second area of the surface, then interpreting the position as a selection of a property for the freehand graphic.

[007] The invention may also include a base enabling the digitization of a freehand graphic. The base may have a surface and, on the surface, a position-coding pattern detectable by an optical sensor. The surface may include both a first area and a second area visually distinct from the first area.

[008] Moreover, the invention may include a computer program for digitizing a freehand graphic. The program may receive a position indicator detected on a position-coding pattern by an optical sensor as the optical sensor moves over a surface. The program may then determine if a position corresponding to the position indicator lies in a first area of the surface and, if the position lies in the first area, interpret the position as defining part of the freehand graphic. The program may also determine if the position corresponding to the position indicator lies in a second area of the surface and, if the position lies in the second area, determine a property for the freehand graphic.

[009] Additionally, the invention may include a computer program for digitizing a freehand graphic. The program may receive from an optical sensor an indicator of a position in a selection area of a position-coding pattern. The program may then determine a visual property mapped to the position in the selection area. Until a new indicator of a position in the selection area of the position-coding pattern is received, the program may apply the visual property to portions of the freehand graphic thereafter drawn by movement of the optical sensor over a drawing area of the position-coding pattern.

[010] The foregoing summarizes only a few aspects of the invention and is not intended to be reflective of the full scope of the invention as claimed. Additional features and advantages of the invention are set forth in the following description, may be apparent from the description, or may be learned by practicing the invention. Moreover, both the foregoing general description and the following

detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

Brief Description of the Drawings

[011] Fig. 1 illustrates a system for inputting freehand graphical information in accordance with an exemplary embodiment of the present invention.

[012] Fig. 2 illustrates a base, with a palette for choosing graphical properties, that is physically separate from the drawing area in accordance with an exemplary embodiment of the present invention.

[013] Fig. 3 illustrates a base enabling the input of freehand graphics in yet another exemplary embodiment of the present invention.

[014] Fig. 4 is a flow chart illustrating steps by which a computer program may process input generated by a writing device moved over a base having a position-coding pattern in accordance with an exemplary embodiment of the present invention.

Detailed Description of Preferred Embodiments

[015] Generally described, the invention may include a method for inputting graphical information into a computer system. The graphical information may arise when a drawing device is moved relative to a base (or surface) having a position-coding pattern detectable by an optical sensor in the drawing device. The computer system may record position information arising from a first area of the base as graphical input while recording position information arising from a second

area of the base as the selection of a property associated with the graphical input. Such a property may be a visual property, such as line type, line thickness, and color.

[016] In an exemplary embodiment, a user may move the drawing device over a sub-area of the second area of the base, thereby selecting the property associated with that sub-area. The computer system may then apply the selected property to some or all portions of a freehand graphic that the user then creates by moving the drawing device over the first area (a drawing area) of the base. In fact, the computer system may continue applying a selected property to any portions of a freehand graphic drawn until selection of a new property, at which point the computer system may thereafter apply the new property to portions of the freehand graphic created after selection of the new property. Alternatively, the computer system may apply a selected property to some or all portions of a freehand graphic that the user has drawn before selection of the property.

[017] Fig. 1 shows a system that may be used for inputting graphical information in accordance with an exemplary embodiment of the present invention. The system may include a drawing device 1 that a user may move over a base 3. As the user does this, the drawing device 1 may deposit an ink trace 5, perhaps of ink, on the base 3, though this is not necessary. The base 3 may be made of an easily erasable material, permitting reuse of the base 3.

[018] A position-coding pattern 7 (shown enlarged) may be printed on the base. The position-coding pattern 7 may be designed so that if part of the pattern

with a certain minimum size is recorded, the corresponding position on the base can be determined unambiguously.

[019] The applicant's Patent Applications WO 00/73983 and PCT/SE00/01895, the technical disclosures of each of which are hereby incorporated herein by reference, disclose a suitable position-coding pattern 7. As these applications teach, each position may be coded by a number of symbols and a symbol may be used to code a number of positions. Also relevant is Patent Application WO/01/16691, the technical disclosure of which is also hereby incorporated herein by reference.

[020] The position-coding pattern 7 shown may be constructed as taught by WO 00/73983, where a large dot represents a "one" and a small dot represents a "zero." But the position-coding pattern 7 may also be as described in PCT/SE00/01895, where different displacements of a dot in relation to a raster point code different symbol values.

[021] The drawing device 1 may use an optical sensor to detect the position-coding pattern 7 and, thereby, the corresponding positions on the surface of the base. When the drawing device 1 moves relative to the base 3 and in contact with the base, the drawing device may record a series of positions on the base 3. The drawing device 1 may then transmit this position information to a microprocessor for interpretation. The microprocessor may be included in a computer system 9, such as a personal computer or a server at a remote location across a network. Alternatively, the microprocessor may be included in a cellular telephone or the drawing device 1 itself.

[022] Transmission of the position information may occur through various types of cable, an infrared link, or a short-range radio link (such as one defined by the BLUETOOTH protocol). Position information may be transmitted as a set of pairs of coordinates or as a polygon train into which such coordinates have been converted.

[023] In one embodiment, the drawing device 1 may generate the position information by movement over a base 3 with a position-coding pattern 7. It then may transmit the position information to a personal computer for processing. Or the personal computer may forward the position information over a network to a server for interpretation.

[024] The drawing device 1 may assign detected positions a time-stamp. This enables the order of graphical inputs to be preserved.

[025] The base 3 may have a first area 11 (a drawing area) and a second area 13 (for choosing properties of the graphical objects drawn in the drawing area). The first area 11 and the second area 13 may be visually separated, perhaps with a printed line 15.

[026] The computer system 9 may have a computer program to interpret position information recorded by the drawing device 1. If the drawing device 1 deposits a trace 5 by moving over the base 3 while in contact with the base, the computer system 9 may record the position information as graphical input 17 because the trace occurred in the first area 11 (drawing area). The graphical input 17 corresponding to the trace 5 may be displayed on the monitor 19 and digitally stored.

[027] In the digitization process, a position recorded within the first area 11 may be stored as a "one," whereas non-activated pixels may be represented by a "zero." Once digitized, a graphical image may be transmitted over a network, perhaps via an e-mail attachment. By storing a time-stamp corresponding to when the drawing device 1 records each position, the system may also be able to reproduce the manner in which a drawing formed.

[028] The computer system 9 may interpret position information recorded by the drawing device 1 while touching the second area 13 as the selection of a visual property for the graphical input created by moving the drawing device over the first area (drawing area) 11. For example, after creating and recording a graphical input 17, the user may point with the drawing device 1 to a sub-area 21 in the second area 13 and thereby assign to the graphical input 17 a property (such as the color blue) associated with this sub-area 21. The order may also be reversed, permitting the user to select a property for the graphical object 17 before creating the object. A sub-area 21 representing a visual property may be provided with a visible, visual indicator 22 indicating the associated property.

[029] The computer system 9 (or, alternatively, a microprocessor capable of performing its functionality) may also be integrated into the drawing device 1. This may enable the drawing device to create a complete graphic image and then transmit it, perhaps by way of a mobile telephone system. The microprocessor for interpreting position information (i.e., determining which positions define the graphic and which select properties for the graphic) may also be incorporated into a mobile telephone.

[030] Fig. 2 shows an alternative embodiment of a base 3'. The base 3' may have a first area 11' and a second area 13'. The first area 11' and the second area 13' may be physically separate units. The first area 11' may enable creation of graphical inputs as a drawing device 1 creates an ink trace while moving over its position-coding pattern. The second area 13' may be used to assign visual properties to the graphical inputs.

[031] When a visual property is chosen, an indication of the selected property may be displayed to the user to confirm the user's property choice. If, for instance, the user chooses the visual property "blue," a personal computer in communication with the drawing device 1 may then display the word "blue" on its monitor. If the drawing device 1 communicates with a cellular telephone, a display on this telephone may likewise display an indication of the property selected. Alternatively, a display on the drawing device itself could achieve this functionality.

[032] Fig. 3 shows a further embodiment of a base 3'' in accordance with an exemplary embodiment of the present invention. The base may be a sheet of paper, an inexpensive solution. It may instead be a synthetic material such as polymer, allowing ink markings on the surface to be erased easily.

[033] The base 3'' may have a position-coding pattern, as well as a first area 11'' and a second area 13''. The first area 11'' may enable creation of graphical inputs via production of a trace 5'' over the position-coding pattern. The second area 13'' may enable assignment of visual properties to the graphical inputs.

[034] The second area 13" may have a number of divisions 23, 25, 27, 29, 31, 33, each containing a number of sub-areas 21". Each sub-area 21" may comprise a set of positions defined by the position-coding pattern. When a computer system in the arrangement detects any of these positions, the position may be interpreted as selection of the visual property corresponding to this sub-area 21".

[035] A visual property may be color information. The area 13" of the base 3" may have a first division 23 and a third division 27 to enable the selection of color information. The sub-areas within the first division 23 are printed with alphanumeric indicators 22" signifying the colors represented by the sub-areas, in this case the color names. The sub-areas in the third division 27 have been colored with the colors (shown here by shading) they represent, providing a language-independent user interface.

[036] The second division 25 may in a similar way represent selectable line thickness properties, and the fourth division 29 may represent line type properties. Typical line types may include solid, dotted, and broken lines.

[037] In Fig. 3, there is shown 16 separate sub-areas in division 31, each labeled with a numeral 0 to 9 or a letter A to F. By pointing at a sequence of these characters, the user can input an arbitrarily long code corresponding to a particular visual property. In this way, a small surface can provide for selection of a large number of properties.

[038] A virtual keyboard (not shown) of letters A to Z (and a to z) and numbers may be provided on the area 13". When the drawing device points at

the sub-area corresponding to such a letter or number, the corresponding letter or number may be inserted in the message. A user may use such a virtual keyboard to specify, for example, an e-mail address, a fax number, or a keyword.

[039] The sub-areas of division 33 may specify the layer in which a graphical input is to be deposited in a drawing. Applying graphical inputs on different layers may prove useful in many applications. For instance, a machine drawing may be completed in a first layer and legends explaining features of the machine may be placed in a second layer. In this way, a user may be able to choose whether or not to display the legends. Different recipients may also be sent different sets of layers. It is also possible to assign different properties (e.g., line width or line color) to different layers.

[040] Visual properties other than those already discussed may be available in other embodiments of the present invention. For example, a graphical input may be assigned a "text" property, making the system apply OCR (Optical Character Recognition) to the input. Text may also be given specific effects (such as "bold" or "italic") when such properties are offered in a property area.

[041] Drawing tools may also be provided by selecting "buttons" in the area 13. For example, selecting the "circle" button may permit the user to draw a circle by only specifying a center and a radius in the drawing area. Other button functions may permit deletion of specific objects, deletion of all objects, and "undo" (deletion of the last object drawn).

[042] Fig. 4 is a flow chart illustrating the steps in a computer program encompassing an exemplary embodiment of the present invention. The program

may be stored on any digital storage medium (for example a diskette). By using the computer program to instruct a microprocessor to carry out these steps, the microprocessor may be adapted to perform embodiments of the invention.

[043] The method begins in step 41. After receiving a position location in step 41 (perhaps from a drawing device deriving it from a position-coding pattern using an optical sensor), the program determines in step 43 if the position lies in the first area 11 of the base. If the position lies in the first area 11 of the base, then the "YES" branch is followed to step 45, and the program interprets and records the position as graphical input. If the position does not lie in the first area 11 of the base, then the "NO" branch is followed from step 43 to step 47, and the program interprets and records the position as a property to be associated with the graphical input. Both step 45 and step 47 loop back to step 41, where the program can receive further position information for processing.

[044] The scope of the patent protection applied for is not restricted to the embodiments described above. The invention can be varied and changed in a number of ways within the scope of the following claims.

[045] Concurrently filed with the application for this patent are applications entitled Systems and Methods for Information Storage based on Swedish Application No. 0000947-2, filed March 21, 2000, and U.S. Provisional Application No. 60/207,839, filed May 30, 2000; Secured Access Using a Coordinate System based on Swedish Application No. 0000942-3, filed March 21, 2000, and U.S. Provisional Application No. 60/207,850 filed on May 30, 2000; System and Method for Printing by Using a Position Coding Pattern based on Swedish

Application No. 0001245-0, filed on April 5, 2000, and U.S. Provisional Application No. 60/210,651, filed on June 9, 2000; Apparatus and Methods Relating to Image Coding based on Swedish Application No. 0000950-6, filed on March 21, 2000, and U.S. Provisional Application No. 60/207,838, filed on May 30, 2000; Apparatus and Methods for Determining Spatial Orientation based on Swedish Application No. 0000951-4, filed on March 21, 2000, and U.S. Provisional Application No. 60/207,844, filed on May 30, 2000; System and Method for Determining Positional Information based on Swedish Application No. 0000949-8, filed March 21, 2000, and U.S. Provisional Application No. 60/207,885, filed on May 30, 2000; Method and System for Transferring and Displaying Graphical Objects based on Swedish Application No. 0000941-5, filed March 21, 2000, and U.S. Provisional Application No. 60/208,165, filed May 31, 2000; Online Graphical Message Service based on Swedish Application No. 0000944-9, filed March 21, 2000, and U.S. Provisional Application No. 60/207,881, filed May 30, 2000; Method and System for Digitizing Freehand Graphics With User-Selected Properties based on Swedish Application No. 0000945-6, filed March 21, 2000, U.S. Provisional Application No. 60/207,882, filed May 30, 2000; Data Form Having a Position-Coding Pattern Detectable by an Optical Sensor based on Swedish Application No. 0001236-9, filed April 5, 2000, and U.S. Provisional Application No. 60/208,167, filed May 31, 2000; Method and Apparatus for Managing Valuable Documents based on Swedish Application No. 0001252-6, filed April 5, 2000, and U.S. Provisional Application No. 60/210,653 filed June 9, 2000; Method and Apparatus for Information Management based on Swedish

Application No. 0001253-4 filed April 5, 2000, and U.S. Provisional Application No. 60/210,652, filed June 9, 2000; Device and Method for Communication based on Swedish Application No. 0000940-7, filed March 21, 2000, and U.S. Provisional Application No. 60/208,166, filed May 31, 2000; Information-Related Devices and Methods based on Swedish Application No. 0001235-1, filed April 5, 2000, and U.S. Provisional Application No. 60/210,647, filed June 9, 2000; Processing of Documents based on Swedish Application No. 0000954-8, filed March 21, 2000, and U.S. Provisional Application No. 60/207,849, filed May 30, 2000; Secure Signature Checking System based on Swedish Application No. 0000943-1, filed March 21, 2000, and U.S. Provisional Application No. 60/207,880, filed May 30, 2000; Identification of Virtual Raster Pattern, based on Swedish Application No. 0001235-1, filed April 5, 2000, and U.S. Provisional Application No. 60/210,647, filed June 9, 2000, and Swedish Application No. 0004132-7, filed November 10, 2000, and U.S. Provisional Application No. _____, filed January 12, 2001; and a new U.S. Provisional Application entitled Communications Services Methods and Systems.

[046] The technical disclosures of each of the above-listed U.S. applications, U.S. provisional applications, and Swedish applications are hereby incorporated herein by reference. As used herein, the incorporation of a "technical disclosure" excludes incorporation of information characterizing the related art, or characterizing advantages or objects of this invention over the related art.

[047] In the foregoing Description of Preferred Embodiments, various features of the invention are grouped together in a single embodiment for purposes of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the following claims are hereby incorporated into this Description of the Preferred Embodiments, with each claim standing on its own as a separate preferred embodiment of the invention.